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In this research, we used the *cacTS2* strain to investigate the potential effects on vision and olfaction in adult *Drosophila*. In larval *Drosophila*, we further assess regulation of heart rate as well as direct action in the heart at restrictive temperatures to further delineate the properties of the *cacTS2* strain. Mutations that are temperature-sensitive provide a good avenue to study the mechanisms of how homeostasis of an organism is regulated over time. Whereas complete knockouts of gene function can sometimes be lethal, the temperature-sensitive mutational forms can be pulsed for various increments of time to assess acute and chronic effects.

Because our knowledge of physiological mechanism largely derives from experiments in the larva (Koh et al., 2000), it is relevant to look at learning behavior in larvae with an alteration in Ca^{2+} function at the synaptic level.

Clinical approaches are used to regulate calcium channel function as a means to control pathological conditions such as epilepsy and convulsions (Warner et al., 2005). The outcome of long-term treatments of calcium channel blockers for regulation of such diseases needs to be addressed in terms of potential consequences in which homeostatic synaptic mechanisms may be compromised. It is possible that by examining effects on the long-term reduction of calcium influx and by simply revealing the mechanism induced by calcium blocking in defined model systems we will gain insight for clinical application.

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I spent the first one and a half years of my undergraduate career here at UK switching majors and mastering what I like to call the art of "add/drop." (I was just as indecisive in finalizing a semester's course schedule.) In fact, I once changed majors three times in a span of two days. Finally, after meeting with professors in areas such as Chemistry, English, and Journalism, I decided that Biology was the major for me. I was especially interested in biomedical research and medicine.

Because I had taken only one collegiate science course, I apprehensively enrolled in organic chemistry and cell biology courses for the spring semester of my sophomore year. At the time, I felt that the semester was greatly important and that my performance in these science courses would indicate, and maybe even shape, my newly founded undergraduate career. However, my Honors 202 course tested me most, but in a different manner than I expected.

Dr. David Wilke taught that course, entitled "The Contemporary World," which required a reading of A.H. Maslow's *The Farther Reaches of Human Nature*. In that book, I discovered the possibility of a different kind of education, and my discovery began with a realization that the state of my education in the opinion of Maslow, at the time, "summarizes the evils of extrinsically oriented education." That is, the numbers, names, facts, and formulas that I had simply been learning and memorizing (and later usually forgetting) are, according to Maslow, "in a certain, very profound sense, expendable."

Although, as I have already mentioned, I was enrolled in the Honors Program (which definitely promotes the development and use of creativity in a cross-disciplinary setting), I had fallen into

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the minimalist undergraduate mindset. At the time, anything above or beyond the requirements of a course were, to me, superfluous. I didn't attend many lectures by visiting professors or guest speakers, and, most importantly, I wasn't involved enough. So, as you can probably imagine, Maslow's idea of a "humanistic education" struck me as completely foreign and challenging but stuck with me. I recognized his idea as rather utopian, but I bound myself to expanding my education and to obtaining as much of an "intrinsic education" as possible in the remaining two years of my undergraduate stay.

Such a goal led me to consider earning credit in BIO 395, Independent Research, and my advisor, Dr. Sheldon Steiner, suggested some biology faculty members who were taking undergraduates in their labs. I studied the professors' areas of research and decided to meet with Dr. Bruce O'Hara, whose specialty is sleep and circadian rhythms. I didn't make an appointment but just showed up at Dr. O'Hara's office (definitely a testament to Dr. O'Hara's availability to his students and his productively relaxed attitude so conducive to creativity in learning and research). After five minutes of speaking with Dr. O'Hara about his research, I was intimidated, felt under-qualified, and wanted to leave; after half an hour, I was absolutely convinced that I was going to do research in Dr. O'Hara's lab. After about eight months of research in his lab, Dr. O'Hara brought to my attention the Beckman Scholars Award for Undergraduate Research and encouraged me to submit an application. It was extensive and required, among other things, a detailed project proposal, three faculty recommendations, and a personal statement concerning my future academic and career plans.

At some point during my first meeting with Dr. O'Hara (probably while he talked excitedly about his latest findings, because his passion and love of knowledge of all kinds is contagious), I was reminded of an essential component of Maslow's education: "peak experiences."

I firmly believe that Dr. Arnold Beckman either was well-acquainted with Maslow's work (or at least similar work), or independently discovered the same truths (brilliant minds think alike). Peak experiences form the foundation of the Beckman Scholars Program, and I'm convinced that Dr. Beckman had them in mind when he and his wife Mabel decided to encourage scientific education both financially and ideologically. Dr. Beckman himself must have lived by and thrived on peak experiences, because he made numerous medical and otherwise scientific inventions. "The picture of the creative scientist

must change, and is giving way to an understanding of the creative scientist, and the creative scientist lives by peak experiences," writes Maslow. "He lives for moments of glory when a problem solves itself, when suddenly through a microscope he sees things in a very different way, the moments of revelation, of illumination, insight, understanding, ecstasy. These are vital for him." I am especially grateful for the assistance that the Beckman Foundation has given to me in my goal of a more intrinsically-oriented education.

My main research project focuses on an examination of "clock-genes" (genes underlying mammals' circadian rhythmicity) that we believe are also important for sleep homeostatic regulation. I'm currently looking at clock-gene mRNA levels in response to sleep deprivation of varying durations in different parts of the mouse brain outside the mammalian master circadian pacemaker, and further comparing these results in different mouse strains with different sleep parameters. We've found that the clock-genes *period1* and *period2* mRNA levels increase with increasing sleep deprivation in both the forebrain and cerebellum of three mouse strains. Such a positive correlation with sleep deprivation further confirms our hypothesis that period clock-gene expression is also related to sleep homeostatic regulation.

I've also been involved in a study regarding human reaction-time performance in relation to meditation, sleep, exercise, and caffeine. We've found that meditation enhances reaction-time performance (i.e., reduces reaction-time) in a Psychomotor Vigilance Task more than sleep, exercise, or caffeine. For this study, we are currently seeking publication in the journal *Sleep*. Following the Dalai Lama's inaugural lecture on the neuroscience of meditation at the 2005 Society for Neuroscience Conference, the media has taken an interest in our meditation study. Dr. O'Hara has recently and frequently been interviewed, and already our findings in the meditation study have been featured in *Time Magazine*, *USA Today*, *New Scientist*, and *Science Update*. I will be presenting both studies' findings at the Society for Neuroscience Conference in October of 2006, and I've already presented preliminary findings of my molecular project at the Kentucky Posters-at-the-Capitol program and at UK's Showcase of Undergraduate Scholars.

The overall goal of my research (and presumably any research in the sleep field) is to contribute to a greater understanding of why we sleep. Today, we still have a poor understanding of the mechanisms underlying a process consuming approximately one-third of our lives! The function(s) of sleep is/are unknown; thus, my area of research is chuck-full of peak experiences waiting to happen. But, above all, above the physiological and molecular pathways important for sleep that I've learned, and above the small contribution that I've made to the research community, I've had a lot of fun. This fall I'll be attending medical school at the University of Louisville, where I plan to continue laboratory research. My career goal is to become involved in the implementation of laboratory research in a patient setting.